Localization with Microsoft Kinect using Natural Features and Depth Data

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ABSTRACT

This paper proposes a localization method using the Microsoft Kinect sensor and natural feature tracking with a red-green-blue (RGB) camera. It is difficult to measure self-position accurately because measurement errors in depth tend to be greater when using only an RGB camera. The Kinect sensor has both an RGB image camera and a depth camera; therefore it can overcome some of these problems. Finally, we provide examples of 3D reconstruction.

KEYWORDS: Kinect, 3D reconstruction, natural feature tracking.

1 INTRODUCTION

It is useful to provide current location information to a user. The Global Positioning System (GPS) is generally used to obtain such information; however, it cannot be used inside buildings. To overcome this problem, many studies have considered using machine vision with cameras. Vision-based localization methods with [1] and without artificial markers [2] have been proposed. However, measuring depth value with only a camera is generally inaccurate. We propose a localization system using Microsoft Kinect, which has both a red-green-blue (RGB) camera and a depth camera.

2 PROCESSING PROCEDURE

Figure 1 shows the procedure of the proposed system. First, the RGB and depth images are calibrated. Then natural feature points are explored, and base points, which are feature points with 3D location data, are selected and stored. Finally, the 3D location of the system (Kinect) is calculated from the base points. Base points are tracked with template matching and their locations are updated.

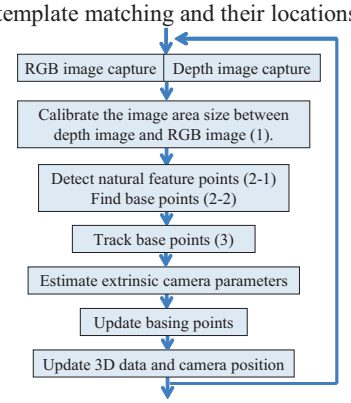

Figure 1. Processing procedure

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3 RESULT

We used this system to estimate the dimensions of a room and a corridor. The room size is about 7.5 m × 6.5 m. The Kinect was located on the marked point in Fig. 2 and rotated 360 degrees on a turntable. Figure 3 shows the result of estimation in the corridor. The width of the corridor is about 1.7 m.

The estimates were repeated 10 times in the room. The average measurement error was 31 cm (± 6 cm standard deviation) in the x-direction, 17 cm (± 3 cm) in the y-direction, and 41 cm (± 12 cm) in the z-direction.

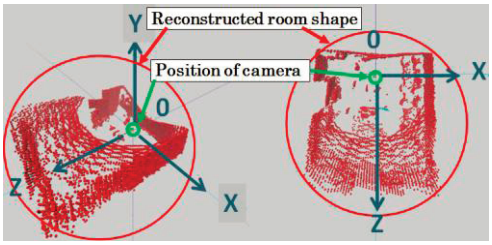

Figure 2. 3D reconstruction result in the room.

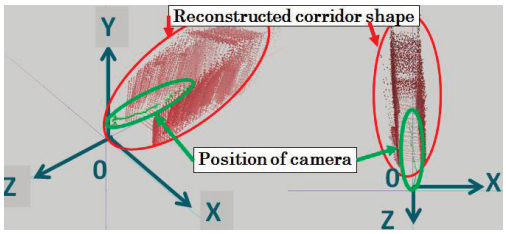

Figure 3. 3D reconstruction result in the corridor.

4 CONCLUSION

This paper proposes a localization method using the Microsoft Kinect sensor. We applied the system to a room and a corridor. The estimation results had a horizontal error of around 40 cm and a vertical error of about 20 cm.

REFERENCES

[1] L. Naimark and E. Foxlin. Circular data matrix fiducial system and robust image processing for a wearable vision-inertial self-tracker. *Proc. IEEE/ACM Int. Symp on Mixed and Augmented Reality*, pp. 27-36, 2002.

[2] M. Oe, T. Sato and N. Yokoya. Estimating camera position and posture by using feature landmark database. *Proc. 14th Scandinavian Conf on Image Analysis (SCIA2005),* volume 13, pp. 171–181, June 2005.

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